SUMMARY AND CONCLUSION
An attempt was undertaken to evaluate the proximate, chemical and microbial quality changes so as to determine the shelf life (period of freshness) of *Hypophthalmichthys molitrix* and *Wallago attu* kept under frozen conditions (-12±2°C) for different storage periods.

The whole course work was divided into 2 parts viz.

- Enhancement of shelf life of raw muscles
- Value addition of raw muscles.

In order to enhance the shelf life of raw muscles, the samples were subjected to different treatments viz. antioxidant (Ascorbic and citric acid) and antimicrobial treatment (Potassium sorbate) and stored for a period of 30 days.

Further, value addition of raw muscles to make ready to cook and serve products in the form of Fish cutlets (stored for 40 days) and Fish noodles (stored for 90 days) was done.

Various biochemical parameters viz; total protein, total fat, ash and moisture content, pH, extract release volume (ERV), free fatty acid (FFA) and thiobarbituric acid
(TBA) were evaluated for all the samples i.e. antioxidant and antimicrobial treated and value added samples.

- Quantitative microbial evaluation viz; total plate count (TPC), coliform count (CC) and psychrophilic count (PC) was done for all the samples.

- Sensory analysis of antioxidant, antimicrobial treated and value added fish muscles was done by 8 point descriptive hedonic scale (Keeton, 1983).

A whole summary of changes occurring in the muscles of *Hypophthalmichthys molitrix* and *Wallago attu* are as:

**PROXIMATE COMPOSITIONAL CHANGES:**

**TOTAL PROTEIN CONTENT (T\(_P\)C):**

- The initial values of protein in fresh samples is high in *Hypophthalmichthys molitrix* (16.5%) than *Wallago attu* (15.45%).

- Raw samples of *Wallago attu* (34.3%) revealed a higher protein loss in comparison to *Hypophthalmichthys molitrix* (28.2%) after 30 days of frozen storage period.

- In case of **Citric acid (CA)** treated samples of *Hypophthalmichthys molitrix*, the total protein loss after 30 days is 17.22% in 0.3% CA, 16.27% in 0.5% CA and 16.19% in 0.7% CA treated samples.

- In case of **Citric acid (CA)** treated samples of *Wallago attu*, the total protein loss after 30 days is 18.32% in 0.3% CA, 17.66% in 0.5% CA and 17.40% in 0.7% CA treated samples.

- In case of **Ascorbic acid (AA)** treated samples of *Hypophthalmichthys molitrix*, the total protein loss after 30 days is 16.87% in 0.3% AA, 16.20% in 0.5% AA and 16.22% in 0.7% AA treated samples.

- In case of **Ascorbic acid (AA)** treated samples of *Wallago attu*, the total protein loss after 30 days is 18.24% in 0.3% AA, 17.12% in 0.5% AA and 17.40% in 0.7% AA treated samples.
Summary and Conclusion

- The lowest percental decrease in protein is observed in fish muscle treated with 0.5% CA + AA (1:1) i.e. 14.92% in Hypophthalmichthys molitrix and 16.72% in Wallago attu.

Thus, considering the protein loss in raw and antioxidant treated muscle samples, following trend emerges:

Raw samples > Citric acid treated > Ascorbic acid > 0.5% Citric acid and ascorbic acid (1:1).

- **Value added Fish cutlets** of Hypophthalmichthys molitrix (16.38%) and Wallago attu (18.20%) reported lower total percental protein loss in comparison to raw samples i.e. 44.24% in H_R and 47.44% in W_R after 40 days of frozen storage period.

- Value added Fish noodles reported higher protein content (21.12%) in comparison to the Veg noodles (8.11%).

**TOTAL LIPID CONTENT (TLC):**

- A decreasing trend was observed in total lipid content of all the samples which indicates the ongoing lipid oxidation and lipid hydrolysis during storage.

- The values of lipid in fresh samples of Wallago attu (4.02%) is higher than Hypophthalmichthys molitrix (2.27%).

- Raw samples of Wallago attu (60.94%) revealed a higher lipid loss in comparison to Hypophthalmichthys molitrix (49.77%) after 30 days of frozen storage period.

- In case of Citric acid (CA) treated samples of Hypophthalmichthys molitrix, the total lipid loss after 30 days is **38.42% in 0.3% CA**, 31.89% in 0.5% CA and 30.04% in 0.7% CA treated samples.

- In case of Citric acid (CA) treated samples of Wallago attu, the total lipid loss after 30 days is **47.81% in 0.3% CA**, 40.28% in 0.5% CA and 39.85% in 0.7% CA treated samples.
• In case of **Ascorbic acid** (AA) treated samples of *Hypophthalmichthys molitrix*,
the total lipid loss after 30 days is **35.74% in 0.3% AA**, 30.63% in 0.5% AA and
29.36% in 0.7% AA treated samples.

• In case of **Ascorbic acid** (AA) treated samples of *Wallago attu*, the total lipid loss
after 30 days is **46.03% in 0.3% AA**, 39.15% in 0.5% AA and 38.49% in 0.7%
AA treated samples.

• The lowest percental decrease in lipid content is observed in fish muscle treated
with 0.5% CA + AA (1:1) i.e. 27.58% in *Hypophthalmichthys molitrix* and 36.09%
in *Wallago attu* after 30 days of frozen storage.

• Thus, considering the lipid loss in raw and antioxidant treated samples, following
trend emerges: Raw samples > Citric acid treated > Ascorbic acid > 0.5% Citric
acid and ascorbic acid (1:1).

• In **Value added Fish cutlets**, the total lipid loss after 40 days of frozen storage
was lower in *Hypophthalmichthys molitrix* (22.93%) and *Wallago attu* (27.95%)
when compared to raw samples i.e. 55.06 % in H_R and 71.39% in W_R after 40
days of frozen storage period.

• Value added Fish noodles (3.82%) reported higher lipid content in comparison to
the Veg noodles (0.76%).

**TOTAL ASH CONTENT (T_A):**

• Due to higher bony content, the initial values of ash in fresh samples of
*Hypophthalmichthys molitrix* (1.48%) is higher than *Wallago attu* (1.03%).

• Raw samples of *Wallago attu* (14.56%) revealed a higher ash loss in comparison
to *Hypophthalmichthys molitrix* (10.13%) after 30 days of frozen storage period.

• In case of **Citric acid** (CA) treated samples of *Hypophthalmichthys molitrix*, the
total ash loss after 30 days is **6.62% in 0.3% CA**, 6.49% in 0.5% CA and 6.45%
in 0.7% CA treated samples.
In case of Citric acid (CA) treated samples of *Wallago attu*, the total ash loss after 30 days is **8.57% in 0.3% CA**, 8.03% in 0.5% CA and 7.27% in 0.7% CA treated samples.

In case of Ascorbic acid (AA) treated samples of *Hypophthalmichthys molitrix*, the total loss in ash content after 30 days is **6.57% in 0.3% AA**, 5.16% in 0.5% AA and 5.09% in 0.7% AA treated samples.

In case of Ascorbic acid (AA) treated samples of *Wallago attu*, the total loss in ash content after 30 days is **7.47% in 0.3% AA**, 7.07% in 0.5% AA and 6.30% in 0.7% AA treated samples.

The lowest percental decrease in ash content is observed in fish muscle treated with 0.5% CA + AA (1:1) i.e. 4.93% in *Hypophthalmichthys molitrix* and 5.21% in *Wallago attu* after 30 days of frozen storage.

Thus, considering the loss in ash content in raw and antioxidant treated muscle samples, following trend emerges:

Raw samples > Citric acid treated > Ascorbic acid > 0.5% citric acid and ascorbic acid (1:1).

Total percental decrease in ash content was lower in Value added Fish cutlets of *Hypophthalmichthys molitrix* (5.48%) and *Wallago attu* (6.87%) in comparison to raw samples i.e. 15.54% in H<sub>R</sub> and 19.41% in W<sub>R</sub> after 40 days of frozen storage period.

Value added Fish noodles (1.54%) reported higher ash content in comparison to the Veg noodles (0.91%).

**TOTAL MOISTURE CONTENT (T<sub>M</sub>C):**

- A decreasing trend was observed in total moisture content of all the samples i.e. raw and antioxidant treated.

- Raw samples of *Wallago attu* (9.30%) revealed a higher lipid loss in comparison to *Hypophthalmichthys molitrix* (8.17%) after 30 days of frozen storage period.
• In case of Citric acid (CA) treated samples of *Hypophthalmichthys molitrix*, the total percental decrease in moisture content after 30 days is **6.28% in 0.3% CA**, 5.80% in 0.5% CA and 5.77% in 0.7% CA treated samples.

• In case of Citric acid (CA) treated samples of *Wallago attu*, the total moisture loss after 30 days is **6.50% in 0.3% CA**, 5.62% in 0.5% CA and 5.58% in 0.7% CA treated samples.

• In case of Ascorbic acid (AA) treated samples of *Hypophthalmichthys molitrix*, the total decrease in moisture content after 30 days is **5.84% in 0.3% AA**, 5.77% in 0.5% AA and 5.62% in 0.7% AA treated samples.

• In case of Ascorbic acid (AA) treated samples of *Wallago attu*, the total moisture loss after 30 days is **5.92% in 0.3% AA**, 5.52% in 0.5% AA and 5.49% in 0.7% AA treated samples.

• The lowest percental decrease in moisture content after 30 days of frozen storage is observed in fish muscle treated with 0.5% CA + AA (1:1) i.e. 4.22% in *Hypophthalmichthys molitrix* and 4.87% in *Wallago attu*.

Thus, considering the decrease in moisture content of raw and antioxidant treated samples, following trend emerges:

Raw samples > Citric acid treated > Ascorbic > 0.5% citric acid and ascorbic acid (1:1).

• The total decrease in moisture content was less in Value added Fish cutlets of *Hypophthalmichthys molitrix* (4.11%) and *Wallago attu* (4.86%) as compared to raw samples i.e. 10.53% in H_R and 11.42% in W_R after 40 days of frozen storage period.

• Value added Fish noodles (8.81%) reported higher moisture content in comparison to the Veg noodles (5.61%).
CHEMICAL CHANGES:

THIOBARBITURIC ACID (TBA):

- An increasing trend was observed in TBA samples for all the samples viz. raw, antioxidant treated and value added samples.

- Higher lipid content of Wallago attu makes it more susceptible to oxidation.

- Raw samples of *Wallago attu* (11.47%) revealed a higher TBA values in comparison to *Hypophthalmichthys molitrix* (10.25%) after 30 days of frozen storage period.

- In case of *Citric acid* (CA) treated samples of *Hypophthalmichthys molitrix*, the TBA content after 30 days is 3.82% in 0.3% CA, 3.75% in 0.5% CA and 3.70% in 0.7% CA treated samples

- In case of *Citric acid* (CA) treated samples of *Wallago attu*, the TBA content after 30 days is 3.90% in 0.3% CA, 3.83% in 0.5% CA and 3.78% in 0.7% CA treated samples.

- In case of *Ascorbic acid* (AA) treated samples of *Hypophthalmichthys molitrix*, the total TBA content after 30 days is 3.80% in 0.3% AA, 3.55% in 0.5% AA and 3.50% in 0.7% AA treated samples

- In case of *Ascorbic acid* (AA) treated samples of *Wallago attu*, the TBA content after 30 days is 3.86% in 0.3% AA, 3.78% in 0.5% AA and 3.72% in 0.7% AA treated samples.

- The lowest values of TBA are observed in fish muscle treated with 0.5% CA + AA (1:1) i.e. 2.75% in *Hypophthalmichthys molitrix* and 3.08% in *Wallago attu* after 30 days of frozen storage.

- The raw samples of *Hypophthalmichthys molitrix* crossed the maximum permissible limits of **8 mg MA per kg** on 30\textsuperscript{th} day and the raw *Wallago attu* samples crossed this limit on 20\textsuperscript{th} day of frozen storage. However, the treatment
with different concentrations of citric acid and ascorbic acid along with their combined treatment maintained the values of TBA within the considered acceptability limits of fish (5–8 mg MA per kg) till the end of storage period of 30 days.

- **Value added Fish cutlets** of *Hypophthalmichthys molitrix* (1.88%) and *Wallago attu* (2.66%) reported lower TBA content after 40 days of frozen storage when compared to raw samples i.e. 12.50 % in H_R and 13.20% in W_R after 40 days of frozen storage period.

- **Value added Fish noodles** (0.667%) reported higher TBA content in comparison to the Veg noodles (0.221%) at the end of 90 days of storage at ambient temperature.

**FREE FATTY ACID (FFA):**

- FFA reported a linear increase in all the samples viz. raw, antioxidant treated and value added samples.

- Raw samples of *Wallago attu* (15.02%) revealed a higher FFA values in comparison to *Hypophthalmichthys molitrix* (14.55%) after 30 days of frozen storage period.

- In case of **Citric acid (CA)** treated samples of *Hypophthalmichthys molitrix*, the FFA content after 30 days is 1.97% in 0.3% CA, 1.88% in 0.5% CA and 1.85% in 0.7% CA treated samples.

- In case of **Citric acid (CA)** treated samples of *Wallago attu*, the FFA content after 30 days is 2.06% in 0.3% CA, 1.99% in 0.5% CA and 1.99% in 0.7% CA treated samples.

- In case of **Ascorbic acid (AA)** treated samples of *Hypophthalmichthys molitrix*, the total FFA content after 30 days is 1.95% in 0.3% AA, 1.84% in 0.5% AA and 1.80% in 0.7% AA treated samples.
In case of **Ascorbic acid (AA)** treated samples of *Wallago attu*, the FFA content after 30 days is 1.99% in 0.3% AA, 1.95% in 0.5% AA and 1.93% in 0.7% AA treated samples.

The lowest values of FFA are observed in fish muscle treated with 0.5% CA + AA (1:1) i.e. 1.68% in *Hypophthalmichthys molitrix* and 1.99% in *Wallago attu* after 30 days of frozen storage.

Thus, considering the development of FFA in raw and antioxidant treated samples, the raw samples of *Hypophthalmichthys molitrix* and *Wallago attu* samples crossed the maximum permissible limits of 5% on 20th day of frozen storage. However, the treatment of samples with different concentrations of citric acid and ascorbic acid along with their combined treatment maintained the values of FFA within the permissible limits till the end of storage period of 30 days.

**Value added Fish cutlets** of *Hypophthalmichthys molitrix* (1.96%) and *Wallago attu* (2.03%) reported lower FFA content after 40 days of frozen storage when compared to raw samples i.e. 15.21 % in H_R and 16.20% in W_R after 40 days of frozen storage period.

**Value added Fish noodles** (1.14%) reported higher FFA content in comparison to the Veg noodles (0.88%) at the end of 90 days of storage at ambient temperature.

**pH:**

- pH of raw fish muscle of both H_R (6.3) and W_R (6.3) was acidic in beginning and then shifted to alkaline side i.e. 7.3 in H_R and 7.4 in W_R at the end of storage period of 30 days.

- pH of citric and ascorbic acid treated samples increased but were still on acidic side and maintained good quality limit till the end of storage of 30 days.

- pH values in **Citric acid (CA)** treated samples of *Hypophthalmichthys molitrix* after 30 days is 6.9 in 0.3% CA, 6.7 in 0.5% CA and 6.5 in 0.7% CA treated samples.
• pH values in Citric acid (CA) treated samples of Wallago attu after 30 days is 6.9 in 0.3% CA, 6.8 in 0.5% CA and 6.7 in 0.7% CA treated samples.

• pH values in Ascorbic acid (AA) treated samples of Hypophthalmichthys molitrix after 30 days is 6.8 in 0.3% AA, 6.8 in 0.5% AA and 6.6 in 0.7% AA treated samples.

• pH values in Ascorbic acid (AA) treated samples of Wallago attu after 30 days is 6.8 in 0.3% AA, 6.7 in 0.5% AA and 6.7 in 0.7% AA treated samples.

• Values of pH after 30 days of storage in fish muscle samples treated with 0.5% CA + AA (1:1) is 6.6 in Hypophthalmichthys molitrix and 6.8 in Wallago attu after 30 days of frozen storage.

• No significant difference was observed in pH of fish cutlets of Hypophthalmichthys molitrix (6.7) and Wallago attu (6.75) on 40th day of storage in respectively.

• pH of fish noodles (6.75) reported lower value when compared to Veg noodles (6.9) at the end of storage period of 90 days.

BACTERIOLOGICAL CHANGES:

TOTAL PLATE COUNT (TPC):

• Frozen raw (untreated, control) samples revealed the highest TPC as compared to those treated with citric acid, ascorbic acid and potassium sorbate during the whole storage period.

• The permissible limits of 6 log cfu/g was crossed by the raw samples Hypophthalmichthys molitrix (6.25 log cfu/g) and Wallago attu (6.50 log cfu/g) on 10th day of frozen storage.

• Among different concentrations of citric acid treated muscles of, the antibacterial efficacy was in the order: 0.7% CA > 0.5% CA > 0.3% CA. Also, the 0.3% CA treated samples of H (6.20 log cfu/g) and W (6.44 log cfu/g) crossed the
permissible limits on 30\textsuperscript{th} day of frozen storage while 0.5% and 0.7% CA treated samples maintained the permissible limits till the end of storage of 30 days.

- Among ascorbic acid treated samples, the trend for antimicrobial activity was 0.7%AA>0.5%AA>0.3%AA. The treated samples \textit{Hypophthalmichthys molitrix} were within the acceptable limits till the end of storage period of 30 days while in case of \textit{Wallago attu}, 0.3% AA treated samples (6.23 log cfu/g) crossed the permissible limits on 30\textsuperscript{th} day of storage while 0.5%AA and 0.7% AA treated samples maintained the permissible limits till the end of storage period of 30 days.

- The combined effect of antioxidants i.e. 0.5% CA+AA (1:1) had best inhibitory effect against bacterial growth in H\textsubscript{C+A} (3.50 log cfu/g) and in W\textsubscript{C+A} (3.61 log cfu/g) after 30 days of frozen storage period.

- Among Potassium sorbate treated samples the trend was:

5% PS> 3% PS> 1% PS.

The permissible limits were crossed by 1% PS treated samples of \textit{Hypophthalmichthys molitrix} (6.20 log cfu/g) and \textit{Wallago attu} (6.50 log cfu/g) on 30\textsuperscript{th} day of storage.

- Value added fish cutlets of \textit{Hypophthalmichthys molitrix} and \textit{Wallago attu} maintained the acceptable limits till the end of storage period of 40 days.

- Fish noodles did not report total plate counts during the whole storage period of 90 days.

**COLIFORM COUNT (CC):**

- The permissible limits of 2.69 log cfu/g was crossed by the raw samples of \textit{Hypophthalmichthys molitrix} (2.93 log cfu/g) and \textit{Wallago attu} (2.98 log cfu/g) on 10\textsuperscript{th} day of storage.

- \textit{Hypophthalmichthys molitrix} samples treated with different concentrations of citric acid were within the permissible limits till the end of storage. However, in
case of *Wallago attu* samples, the **0.3% CA** treated samples (2.76 log cfu/g) crossed the permissible limits on 20\textsuperscript{th} day of storage while 0.5%CA and 0.7% CA treated samples were within the acceptable limits till the end of storage of 30 days.

- In different concentrations of Ascorbic acid treated samples of *Hypophthalmichthys molitrix*, the permissible limits were not crossed till the end of 30days of storage while in case of *Wallago attu* samples, the **0.3% AA** treated samples (2.90 log cfu/g) crossed the permissible limits on 30\textsuperscript{th} day of storage while 0.5%CA and 0.7% CA treated samples maintained the acceptable limits till the end of storage of 30 days.

- The combined effect of antioxidants i.e. **0.5% CA+AA (1:1)** had best inhibitory effect against bacterial growth in H\textsubscript{C+A} (1.94 log cfu/g) and in W\textsubscript{C+A} (2.10 log cfu/g) upto the end of storage period of 30 days.

- Among different concentrations of Potassium sorbate treated samples, the permissible limits for CC were crossed by **1% PS** treated samples on 30\textsuperscript{th} day in *Hypophthalmichthys molitrix* (3.10log cfu/g) and on 20\textsuperscript{th} day in *Wallago attu* (2.70 log cfu/g). 3%PS and 5%PS treated samples did not crossed the permissible limits till the end of frozen storage period of 30 days.

- Value added fish cutlets of *Hypophthalmichthys molitrix* and *Wallago attu* maintained the acceptable limits till the end of storage period of 40 days.

- Fish noodles did not report total plate counts during the whole storage period of 90 days.

**PSYCHROPHILLIC COUNT (PC):**

- The permissible limits of 4.6 log cfu/g for PC was crossed by the raw samples *Hypophthalmichthys molitrix* (4.75 log cfu/g) and *Wallago attu* (4.88 log cfu/g) on 10\textsuperscript{th} day of frozen storage.

- Among different concentrations of citric acid treated muscles of, the antibacterial efficacy was in the order: **0.7% CA>0.5%CA>0.3%CA**. *Hypophthalmichthys*
molitrix samples treated with different concentrations of citric acid were within the permissible limits till the end of storage. However, in case of Wallago attu samples, the 0.3% CA treated samples (4.80 log cfu/g) crossed the permissible limits on 30th day of storage while 0.5%CA and 0.7% CA treated samples were within the acceptable limits till the end of storage of 30 days.

- Among ascorbic acid treated samples, the trend for antimicrobial activity was 0.7%AA>0.5%AA>0.3%AA and the treated samples Hypophthalmichthys molitrix were within the acceptable limits till the end of storage period of 30 days while in case of Wallago attu, 0.3% AA treated samples (4.60 log cfu/g) reached the permissible limits on 30th day of storage while 0.5%AA and 0.7% AA treated samples maintained the permissible limits till the end of storage period of 30 days.

- The combined effect of antioxidants i.e. 0.5% CA+AA (1:1) had best inhibitory effect against bacterial growth in H C+A (2.75 log cfu/g) and in W C+A (3.08 log cfu/g) after 30 days of frozen storage period.

- Among Potassium sorbate treated samples the trend was: 5% PS> 3% PS> 1% PS. The permissible limits were crossed by 1% PS treated samples of Hypophthalmichthys molitrix (4.70 log cfu/g) on 30th day and Wallago attu (4.61 log cfu/g) on 30th day of storage.

- Value added fish cutlets of Hypophthalmichthys molitrix and Wallago attu maintained the acceptable limits till the end of storage period of 40 days.

- Fish noodles did not report Psychrophillic counts during the whole storage period of 90 days.

**SENSORIAL CHANGES:**

- For sensory evaluation of raw, antioxidant and antimicrobial treated samples various parameters were used viz; appearance and colour, texture, odor and overall acceptability. For Value added products (Fish cutlets and Fish noodles), flavour and juiciness were also analyzed. In the present study, the sensory scores
of *Hypophthalmichthys molitrix* and *Wallago attu* showed an inverse relationship with frozen storage period i.e, it decreased significantly (p<0.05) with increase in storage period.

- The muscle of *Wallago attu* showed the lower overall acceptance score at the end of sensory analysis, in raw, treated (antioxidant and antimicrobial) and value added samples.

- Raw samples of *Hypophthalmichthys molitrix* and *Wallago attu* were analyzed only upto 10th day of frozen storage after which they crossed the organoleptic acceptability.

- Further, among the antioxidants, 0.5% Citric acid and ascorbic acid had the highest overall acceptability, followed by ascorbic acid and citric acid after 30 days of frozen storage.

- Among antimicrobial treated samples, the overall acceptability followed the following trend 5% Potassium sorbate>3% Potassium sorbate >1% Potassium sorbate.

- In Value added Fish cutlets, the overall acceptability was up to 40 days under frozen storage.

- Fish noodles received higher sensory scores and greater overall acceptability (5.02) in comparison to the Veg noodles (4.12) at the end of 90 days of storage at ambient temperature.

- Thus, it can be safely inferred from the present investigation that the treated (antioxidant and antimicrobial) muscle remain nutritionally fit for human consumption up to 30th day of frozen storage, whereas raw samples had a maximum shelf life of 10 days, after which the proximate compositional percentage falls drastically i.e. beyond it these samples become nutritionally poor.

- Also, the Value addition done to the fish muscles (Fish cutlets and Fish noodles), besides enhancing taste, add to the nutritive value when compared to raw samples.
Recommendations:

High quality fishery production requires the responsible involvement of each stake holder in the production chain i.e. from fishermen → factory suppliers → processors → distributers and resource managers → vendors → consumers etc. So as to keep the fish under good quality, it requires the following measures:

- There must be careful handling of the fish after catching.
- Cleanliness, the key to quality assurance should also be maintained in fishing vessels. In wholesale markets, fish stock should not be put on the ground or floors which can enhance spoilage through contamination. Clean water should be used by vendors for washing fish. Besides, the quality of ice for the upkeep of freshness had to be maintained at all costs.
- Contact surfaces such as counter tops, cutting boards and utensils must be thoroughly cleaned before and after use so as to prevent cross contamination.
- Fish vendors should be advised to keep fish of different catch days in different containers making it easy to assess their freshness and keeping quality and to reduce mass losses due to putrefaction.
- Consumers, when purchasing fish, must be aware of quality parameters viz. Reflective and curved eyes, firm meat, clear and odorless slime, bright red and moist gills, neutral smell and tight anal opening.
- An insulated bag with ice to store fish after purchase must be carried. This ensures that the cold chain is maintained and product quality and safety is not compromised.
- In order to enhance the shelf life of fish, the fish must be kept in pre-processed form in freezer using some good antioxidant or antimicrobial solution, brining, smoking, ice glazing, vacuum packaging etc.
• So as to keep in phase with consumers busy life style, needs and demands for safe and healthy food, Value addition of the fish meat in the form of ready to cook and eat products can serve a better alternative.

“Give a man a fish and you feed him for a day; teach a man to fish, you feed him for a lifetime ……. and the present results teach him a Good preserving technique and you may conserve the taste and extend the shelf life”.